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(11) CA 2 448 224 (13) A1

(40) 03.01.2003
(43) 03.01.2003

(12)

(21) 2 448 224

(22) 24.06.2002

(51) Int. Cl.7: G03B 25/02

(85) 24.11.2003

(86) PCT/US02/020277

(87) WO03/001484

(30) 60/300,173 US 22.06.2001

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(54) UNITE D'AFFICHAGE D'IMAGES MULTIPLES PRESENTANT UN MECANISME DE DEPLACEMENT DE SUPPORT
(54) MULTI-IMAGE DISPLAY UNIT WITH MEDIUM DISPLACING MECHANISM

(57)

A display unit having a frame (110), a wall of lenticular lenses (115) an image-carrying medium (135), an electric motor (230) and a gear assembly (170) for imparting reciprocal vertical motion to the image carrying means.

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CA 2448224 A1 2003/01/03

(21) 2 448 224

(12) DEMANDE DE BREVET CANADIEN
CANADIAN PATENT APPLICATION

(13) A1

(86) Date de dépôt PCT/PCT Filing Date: 2002/06/24
(87) Date publication PCT/PCT Publication Date: 2003/01/03
(85) Entrée phase nationale/National Entry: 2003/11/24
(86) N° demande PCT/PCT Application No.: US 2002/020277
(87) N° publication PCT/PCT Publication No.: 2003/001484
(30) Priorité/Priority: 2001/06/22 (60/300,173) US

(51) Cl.Int.^{7}/Int.Cl.^{7} G03B 25/02
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(54) Titre : UNITE D'AFFICHAGE D'IMAGES MULTIPLES PRESENTANT UN MECANISME DE DEPLACEMENT DE SUPPORT

(54) Title: MULTI-IMAGE DISPLAY UNIT WITH MEDIUM DISPLACING MECHANISM

(57) Abrégé/Abstract:
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(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
3 January 2003 (03.01.2003)

PCT

(10) International Publication Number
WO 03/001484 A3

(51) International Patent Classification⁷: G03B 25/02

(21) International Application Number: PCT/US02/20277

(22) International Filing Date: 24 June 2002 (24.06.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
60/300,173 22 June 2001 (22.06.2001) US

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(81) Designated States *(national)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VN, YU, ZA, ZM, ZW.

(84) Designated States *(regional)*: ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

Published:

— *with international search report*

— *before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments*

(88) Date of publication of the international search report:
6 November 2003

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

WO 03/001484 A3

(54) Title: MULTI-IMAGE DISPLAY UNIT WITH MEDIUM DISPLACING MECHANISM

(57) Abstract: A display unit having a frame (110), a wall of lenticular lenses (115) an image-carrying medium (135), an electric motor (230) and a gear assembly (170) for imparting reciprocal vertical motion to the image carrying means.

MULTI-IMAGE DISPLAY UNIT WITH MEDIUM DISPLACING MECHANSIM

FIELD OF THE INVENTION

The invention relates generally to multi-image display units, and particularly to multi-image display units with a gear assembly for raising and lowering an image carrying medium.

BACKGROUND OF THE INVENTION

Image display devices of the type disclosed in JP HEI 2[1990] – 211437, US Pat. No. 6,219,948 and US Pat. No. 6,226,906 (each of which is incorporated herein by reference) are known in the art. In such devices, an image carrying medium having at least two images interlaced and placed thereon in a manner known in the art (e.g., US Pat. No. 5,100,330 and US Pat. No. 5,488,451, each of which is incorporated herein by reference) moves behind a panel of lenticular lenses so that a stationary viewer may see a changing image through the panel of lenses.

Several mechanisms for effectuating such movement of the medium are known in the art. For example, JP 211437 discloses a cam mechanism for such movement and furthermore discloses several rack and pinion or feed screw mechanisms, each of which comprises a motor with the ability to change rotational direction and a means for identifying a proper time to switch such direction. US 6,219,948 and US 6,226,906 both disclose a cam attached to a mono-directional battery-powered drive.

The present invention provides a multi-image display unit with a gear assembly for effectuating movement of the image carrying medium.

SUMMARY OF THE INVENTION

According to one embodiment of the current invention, a display unit having a frame, a wall of lenticular lenses, an image carrying medium, an electric motor and a gear assembly for imparting reciprocal vertical motion to the image carrying medium is provided. According to another embodiment of the current invention, the gear assembly has a pinion gear, a guided ring gear and a frame, whereby the pinion gear and the frame trap the guided ring gear, and whereby rotation of the pinion gear makes the guided ring gear orbit around

the pinion gear. The vertical motion component of the guided ring gear's orbit imparts motion to the image carrying medium.

According to another embodiment of the current invention, a two-sided display unit is provided. The two-sided display unit has two lenticular lens walls and an image carrying medium with images on both sides of the medium.

An advantage of the current invention is that rotational motion provided by a motor may be translated into linear motion by use of a gear assembly rather than by use of a cam or rack and pinion or feed screw mechanisms. Still further advantages of the current invention will become apparent to those of ordinary skill in the art upon reading and understanding the following detailed description of the preferred embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

In the accompanying drawings which are incorporated in and constitute a part of the specification, embodiments of the invention are illustrated, which, together with a general description of the invention given above, and the detailed description given below, serve to example the principles of this invention.

Figure 1 is an exemplary front view of a display unit in accordance with one embodiment of the current invention.

Figure 2 is an exemplary cross-sectional view of a display unit in accordance with one embodiment of the current invention.

Figure 3 is an exemplary cross-sectional view of a display unit in accordance with one embodiment of the current invention.

Figure 4 is an exemplary exploded view of a medium displacing mechanism in accordance with one embodiment of the current invention.

Figure 5 is an exemplary perspective view of a guided ring gear in accordance with one embodiment of the current invention.

Figure 6 is an exemplary perspective view of a guided ring gear in accordance with one embodiment of the current invention.

Figure 7 is an exemplary perspective view of another guided ring gear in accordance with one embodiment of the current invention.

Figure 8 is an exemplary perspective view of yet another guided ring gear in accordance with one embodiment of the current invention.

Figure 9 is an exemplary perspective view of still another guided ring gear in accordance with one embodiment of the current invention.

Figure 10 is an exemplary cross-sectional view of a medium displacing mechanism in accordance with one embodiment of the current invention.

DETAILED DESCRIPTION OF THE ILLUSTRATED EMBODIMENTS

Illustrated in Figure 1 is an exemplary multi-image display unit in accordance with one embodiment of the present invention. The display unit has a frame 110 which encloses a front lenticular lens wall 115 and receives an image carrying medium 135 behind the lenticular lens wall. Frame 110 is composed of any suitable material, including but not limited to light-weight and durable plastic. Frame 110 is suitably shaped and sized to receive front lenticular lens wall 115 and image carrying medium 135.

Referring also to Figure 2, front lenticular lens wall 115 has a lenticular front face 215 and a flat rear face 220. Lenticular front face 215 has an array of lenticular lenses 120. Lenticular lenses 120 are shaped, sized and spaced as known in the art (e.g., US Pat. No. 6,226,906 and US Pat. No. 6,219,948 and the references cited therein) so that when an interlaced image as also known in the art is vertically displaced behind the array of lenticular lenses, a stationary viewer viewing the array of lenses sees a consecutive series of individual, changing images.

Referring again to Figure 1, image carrying medium 135 has a front face 140 upon which at least two interlaced images 155 reside. In the example set forth in Figure 1, a first image of the letter "A" is interlaced with a second image of the letter "B" in a manner known in the art (e.g., US Pat. No. 5,100,330 and US Pat. No. 5,488,451 and US Pat. No. 6,226,906 and US Pat. No. 6,219,948). Image carrying medium is composed of any suitable light weight material, including film. Interlaced images are composed of any suitable material and placed upon image carrying medium by any suitable method. While this example illustrated two interlaced images, it will be understood that any suitable number of images may be interlaced.

Referring to Figure 2, a cross-section of an embodiment of the current invention including a single lenticular lens wall is illustrated. Frame 110 has a back wall 210 and includes a lenticular lens wall 115 which has a lenticular front face 215 and a flat rear face 220. Back wall 210, flat rear face 220 and the first and second side walls (not illustrated in this cross-sectional view) define cavity 225 within which image carrying medium 135 is disposed. Front face 140 of image carrying medium 135 faces the flat rear face 220 of the lenticular lens wall 115 and is spaced a distance from the rear face at most equaling a focal length of a lenticular lens of the lenticular front face. It will be understood that front face 140 may be any suitable distance from flat rear face 220 so that viewing by a stationary viewer is facilitated.

The bottom edge 150 of the image carrying medium rests on a component of medium displacing mechanism 170. As illustrated further in Figures 4 and 10, bottom edge 150 rests upon guided ring gear 415, which is captured between frame 420 and pinion gear 410. Bottom edge 150 is further captured in slot 460 defined by frame 420. Medium displacing mechanism 170 is coupled to electric motor 230 which is coupled to power supply 235. Electric motor 230 is any suitable motor for providing rotational motion, including but not limited to a battery-powered DC drive. An example of such a batter-powered DC drive is a generally available clock motor. Power supply 235 is any suitable power supply for electric motor 230, including but not limited to a battery or a series of batteries to power a DC drive.

Image carrying medium 135 is received into frame 110 through a slot (not shown) and behind lenticular lens wall 115. Frame further has a first 125 and a second 130 side wall positioned behind the lenticular lens wall 115 spaced apart a distance illustrated by 160. Image carrying medium 135 has a width 165 which is defined as slightly less in magnitude than width 160, whereby image carrying medium 135 may slide freely up and down between first 125 and second 130 walls, while both horizontal movement or rotational movement of image carrying medium 135 is restricted. Lenticular lens wall 115, first 125 and second 130 side wall and back wall 210 (referring additionally to Figure 210) define a cavity 215 within which image carrying medium 135 resides and is vertically displaced.

Image carrying medium further has a bottom edge 145. When disposed in cavity 215, the bottom edge (illustrated as 150 in the cut-out of Figure 1) of the image carrying medium rests upon medium displacing mechanism 170. While this embodiment describes the image carrying medium as "resting" upon a medium displacing mechanism, it will be understood that image carrying medium may only indirectly abut medium displacing mechanism, so long

as motion of the medium displacing mechanism is translated to the image carrying medium. As medium displacing mechanism 170 moves, the vertical component of this movement is transferred to image carrying medium 135, which reciprocatingly moves vertically up and down. Any horizontal movement of medium displacing mechanism which is transferred to the image carrying medium is negated by side walls 125 and 130. As image carrying medium moves vertically behind lenticular lens wall 115, a stationary viewer will view a series of changing images as each interlaced image on the face of image carrying medium 135 comes into focus of the array of lenticular lenses 120. In the example of Figure 1, a viewer would see a continuing sequence of alternating letters "A" and "B."

Referring to Figure 3, a cross-section of an embodiment of the current invention including two lenticular lens walls is illustrated. In this embodiment, frame 110 encloses a first lenticular lens wall 310 and a second lenticular lens wall 315. Each of the first and second lenticular lens walls has a lenticular front face and a flat rear face and are disposed so that the flat rear face of each is facing each other. In this position, the lenticular front face of each lenticular lens wall faces outward from the frame in opposite directions. The flat rear faces of each lenticular lens wall and the first and second side walls (not illustrated) define a cavity 320 for receiving image carrying medium 135.

Image carrying medium 135 here has a first 325 and a second 330 face, each of which has at least two interlaced images thereupon. The bottom edge of the image carrying medium 135 rests upon a component of the medium displacing mechanism 170, which is coupled to motor 230 which is powered by power supply 235. As the medium displacing mechanism 170 vertically displaces image carrying medium 135 in cavity 320 behind both lenticular lens walls, a stationary viewer on either side of the display unit may view consecutively changes images.

In each embodiment of the current invention, image carrying medium 135 is vertically displaced in a cavity within the frame by the medium displacing mechanism. The medium displacing mechanism converts rotational motion provided by the electric motor into at least reciprocal vertical motion which is imparted to the image carrying medium. In one embodiment of the current invention, referring to Figure 4, medium displacing mechanism has a pinion gear 410, a guided ring gear 415 and a frame 420.

Pinion gear 410 is attached to shaft 440 which protrudes from motor 230. In an embodiment, motor 230 is mounted on a printed circuit board 435 and shaft 440 protrudes

through a hole in the printed circuit board to attach to pinion gear 410. Pinion gear 410 has external radial teeth 425 and a concentric cylindrical hub 430. The cylindrical hub 430 extends axially and concentrically on the side of the pinion gear opposite motor 230. Shaft 440 is attached concentrically to pinion gear 410 to provide rotary motion to pinion gear 410.

Referring to Figures 4, 5 and 6, guided ring gear 415 has a ring gear 510 and an appended guide portion 515. Ring gear 510 has a hollow 520 and internally extending radial teeth 525. Appended guide portion 515 has a first cylindrical pin 530 which extends concentrically into hollow 520 of ring gear 510. Appended guide portion 515 further has a third cylindrical pin 615 that extends from the side of the appended guide portion 515 opposite the position of the ring gear 510 and concentric with first cylindrical pin 530. In an embodiment, appended guide portion further has a second cylindrical pin 610 on the same side as the third cylindrical pin.

Referring to Figure 4, frame 420 has first 445 and second 450 outside ends which partially define a vertical slot 460 for receiving the bottom of the image carrying medium. In an embodiment, frame 420 has a pin channel 465 on an interior back wall. In another embodiment, frame 420 has an oval depression on an interior back wall (illustrated in Figure 10).

Referring to Figures 4 and 10, the guided ring gear 415 is placed over the pinion gear 410 so that the external teeth 425 of the pinion gear 410 mesh with the internal teeth 525 of the guided ring gear 415. Simultaneously, the central cylindrical hub 430 of the pinion gear 410 contacts the first cylindrical pin 530 of the guided ring gear 415. Pinion gear 410, central cylindrical hub 430, external teeth 425, guided ring gear 415, first cylindrical pin 530 and internal teeth 525 are suitably sized, shaped and spaced so that guided ring gear 415 frictionally fits over pinion gear 410. Frame 420 is positioned over the guided ring gear 415. Guided ring gear 415 is thus captured on one side by pinion gear 410 and on the other side by frame 420.

When motor 230 is activated, the motor causes shaft 440 to rotate. The rotating shaft causes the pinion gear 410 to rotate. As the pinion gear rotates, its teeth mash with the internal teeth of the guided ring gear 415. Because the guided ring gear 415 is captured between the frame 420 and the pinion gear 410 (and, in an embodiment, particle circuit board 435), as the pinion gear rotates, the guided ring gear orbits around the pinion gear. The orbit of the guided ring gear has both a vertical component and a horizontal component. The

vertical component is imparted to the image carrying medium by the image carrying medium at least indirectly abutting the guided ring gear.

Referring to Figures 4 and 6, in an embodiment, any horizontal motion imparted to the image carrying medium from the horizontal component of the guided ring gear's orbit is at least partially restricted by second cylindrical pin 610 on guided ring gear 415. Second pin 610 is received in pin channel 465 of frame 420. Pin channel 465 is disposed in an interior wall of the frame 420 which faces guided ring gear 415 and sized to receive second pin 610 and allow vertical movement of the pin while restricting horizontal movement of the second pin 610.

Referring to Figures 4, 6 and 10, in another embodiment, any horizontal motion imparted to the image carrying medium from the horizontal component of the guided ring gear's orbit is at least partially restricted by third cylindrical pin 615 on guided ring gear 415. Third cylindrical pin 615 is received in oval depression 1010 of frame 420. Oval depression 1010 is disposed in an interior wall of the frame 420 which faces guided ring gear 415 and sized to receive third cylindrical pin 615 and allow movement of the third cylindrical pin 615 only to the extent of the shape of the oval depression 1010.

Referring to Figures 4 and 5, in another embodiment, any horizontal motion imparted to the image carrying medium from the horizontal component of the guided ring gear's orbit is at least partially restricted by outside ends 445 and 450 of frame 420. In this embodiment, appended guide portion 515 has a first 535 and a second 540 sides, the width between which is defined as slightly less than the distance between outside ends 445 and 450. When frame 420 is placed over guided ring gear 415, appended guide portion's first and second ends restrict horizontal movement of the guided ring gear.

The image carrying medium at least indirectly abuts or rests upon any suitable component of the medium displacing mechanism. Referring to Figure 6, in one embodiment, image carrying medium 135 rests upon third cylindrical pin 615. Referring to Figure 7, in another embodiment, third cylindrical pin 615 takes the shape of a three-dimensional parallelogram extending from the guided ring gear. In the example of Figure 7, the three-dimensional parallelogram is a triangular extension 710, and the image carrying medium rest upon the point at one of the angles of the triangular extension. While a triangular extension is illustrated, it will be understood that any suitable shape may be used. Referring to Figure 8, in another embodiment, third cylindrical pin 615 takes the shape of a bar 810, where the

image carrying medium rests upon the flat top of the bar. Referring to Figure 9, in yet another embodiment, the third cylindrical pin 615 is eliminated, and the outer periphery 910 of the ring gear 410 is extended over the appended guide portion 515. In this embodiment, the image carrying medium rests upon the outer periphery 910 of the guided ring gear.

While the present invention has been illustrated by the description of embodiments thereof, and while the embodiments have been described in considerable detail, the scope of the appended claims should not be restricted or in any way limited to such detail. Additional advantages and modifications will readily appear to those skilled in the art. Therefore, the invention, in its broader aspects, is not limited to the specific details, the representative systems, and illustrative examples shown and described. Accordingly, departures may be made from such details without departing from the spirit or scope of the invention disclosed herein.

We claim:

1. A display unit comprising:

a. a frame having at least one back wall, at least two side walls and at least one front lenticular lens wall, the lenticular lens wall being made of a plurality of linear lenses having a lenticular front face and a flat rear face; the back wall, the side walls and the lenticular lens wall defining a cavity therebetween;

b. at least one image carrying medium having a front face and a bottom edge and disposed in the cavity whereby the front face of the medium faces the flat rear face of the lenticular lens wall and is at a distance from the rear face at most equaling a focal length of a lens of the lenticular front face; the front face having thereon at least two images interlaced among each other; the medium having a width defined as slightly less than the distance between the side walls, whereby the side walls allow vertical movement of the medium within the cavity while restricting lateral and rotational movement of the medium within the cavity;

c. medium displacing means for imparting at least reciprocal vertical movement to the medium; and

d. at least one electric motor coupled to the medium displacing means whereby rotational motion from the motor is imparted to the medium displacing means.

2. The display unit of claim 1 wherein the medium displacing means translates rotational motion from the motor into at least reciprocal vertical motion of the medium.

3. The display unit of claim 1 wherein the bottom edge of the medium is supported by the medium displacing means.

4. The display unit of claim 4 wherein the bottom edge of the medium abuts the medium displacing means.

5. The display unit of claim 1 wherein the medium displacing means comprises:

a pinion gear, a guided ring gear and a frame;

the pinion gear having external radial teeth and a concentric, cylindrical hub extending axially and concentrically on a side of the pinion gear opposite the motor; the pinion gear coupled to the motor whereby rotational motion from the motor is translated to rotational motion of the pinion gear and the cylindrical hub;

the guided ring gear having a ring gear and an appended guide portion; the ring gear being generally a ring having a hollow and internally extending radial teeth; the appended guide portion having a first cylindrical pin extending concentrically into the hollow of the ring gear, means for restricting horizontal movement, and means for supporting the medium;

the frame sized to receive the pinion gear and the guided ring gear and having at least two outside ends defining a vertical slot;

the guided ring gear positioned over the pinion gear so that the external teeth of the pinion gear mesh with the internal teeth of the ring gear and so that the cylindrical hub of the pinion gear contacts the first cylindrical pin of the guided ring gear, the frame positioned over the guided ring gear so that the guided ring gear is captured between the frame and the pinion gear, whereby rotation of the pinion forces the captured guided ring gear to orbit around the pinion gear.

6. The display unit of claim 5 wherein the pinion gear is coupled to the motor by a shaft extending from the motor to a side of the pinion gear facing the motor; the shaft coupled axially and concentrically to the side of the pinion gear facing the motor.

7. The display unit of claim 5 wherein the means for restricting horizontal movement comprises:

a pin channel disposed in an interior wall of the frame which faces the guided ring gear and sized to receive a cylindrical pin and allow vertical movement of the pin while restricting horizontal movement of the pin; and

a second cylindrical pin extending from a side of the appended guide portion opposite from the first pin and further extending into the pin channel.

8. The display unit of claim 5 wherein the means for restricting horizontal movement comprises:

the appended guide portion having a first and a second side, the width of the appended guide portion between the first and second sides defined as slightly less than the distance between the outside ends of the frame, whereby the frame will allow vertical movement of the appended guide portion while restricting horizontal movement of the appended guide portion.

9. The display unit of claim 5 wherein the means for restricting horizontal movement comprises:

an oval depression disposed in an interior wall of the frame which faces the guided ring gear and sized to receive the means for supporting the medium.

10. The display unit of claim 5 wherein the means for supporting the medium comprises a third cylindrical pin concentric with the first pin and extending from a side of the appended guide portion opposite from the first pin.

11. The display unit of claim 5 wherein the means for supporting the medium comprises a bar extending from a side of the appended guide portion opposite from the first pin.

12. The display unit of claim 5 wherein the means for supporting the medium comprises a three-dimensional parallelogram extending from a side of the appended guide portion opposite from the first pin.

13. The display unit of claim 5 wherein the means for supporting the medium comprises the outer periphery of the ring gear.

14. The display unit of claim 5 wherein the means for supporting the medium extends into the vertical slot, a part of the bottom edge of the medium is received in the vertical slot and abuts the means for supporting the medium.

15. The display unit of claim 1 wherein the motor is battery powered and the display unit further comprises a battery power source.

16. A display unit comprising:

a. a frame having at least two side walls and containing at least a first and a second lenticular lens wall, each lenticular lens wall being made of a plurality of linear lenses

having a lenticular front face and a flat rear face, the flat rear face of each lenticular lens wall facing each other, and the lenticular front face of each lenticular lens wall facing outward of the frame; the side walls and the flat rear faces of the lenticular lens walls defining a cavity therebetween;

b. at least one image carrying medium having a first face on a first side, a second face on an opposing second side and a bottom edge; the image carrying medium disposed in the cavity whereby the first face of the medium faces the flat rear face of the first lenticular lens wall and the second face of the medium faces the flat rear face of the second lenticular lens; the image carrying medium disposed at a distance from the rear face of each lenticular lens wall at most equaling a focal length of a lens of either lenticular front face; each face having thereon at least two images interlaced among each other; the medium having a width defined as slightly less than the distance between the side walls, whereby the side walls allow vertical movement of the medium within the cavity while restricting lateral and rotational movement of the medium within the cavity;

c. a pinion gear, a guided ring gear and a frame; the pinion gear having external radial teeth and a concentric, cylindrical hub extending axially and concentrically on a side of the pinion gear opposite the motor; the pinion gear coupled to the motor whereby rotational motion from the motor is translated to rotational motion of the pinion gear and the cylindrical hub;

the guided ring gear having a ring gear and an appended guide portion; the ring gear being generally a ring having a hollow and internally extending radial teeth; the appended guide portion having a first cylindrical pin extending concentrically into the hollow of the ring gear, means for restricting horizontal movement, and means for supporting the medium;

the frame sized to receive the pinion gear and the guided ring gear and having at least two outside ends defining a vertical slot;

the guided ring gear positioned over the pinion gear so that the external teeth of the pinion gear mesh with the internal teeth of the ring gear and so that the cylindrical hub of the pinion gear contacts the first cylindrical pin of the guided ring gear, the frame positioned over the guided ring gear so that the guided ring gear is captured between the

frame and the pinion gear, whereby rotation of the pinion forces the captured guided ring gear to orbit around the pinion gear; and

d. at least one electric motor coupled to the medium displacing means whereby rotational motion from the motor is imparted to the medium displacing means.

17. The display unit of claim 16 wherein the means for restricting horizontal movement comprises:

a vertical slot disposed in an interior wall of the frame which faces the guided ring gear and sized to receive a cylindrical pin and allow vertical movement of the pin while restricting horizontal movement of the pin; and

a second cylindrical pin extending from a side of the appended guide portion opposite from the first pin and further extending into the vertical slot.

18. The display unit of claim 16 wherein the means for supporting the medium comprises a three-dimensional parallelogram extending from a side of the appended guide portion opposite from the first pin.

19. The display unit of claim 16 wherein the means for supporting the medium comprises the outer periphery of the ring gear.

20. In a display unit having a frame having at least two side walls and at least one lenticular lens wall, the lenticular lens wall being made of a plurality of linear lenses having a lenticular front face and a flat rear face, the side walls and the lenticular lens wall defining a cavity therebetween, at least one image carrying medium having at least one face and a bottom edge and disposed in the cavity whereby the at least one face of the medium faces the flat rear face of the at least one lenticular lens wall and is at a distance from the rear face at most equaling a focal length of a lens of the at least one face, the at least one face having thereon at least two images interlaced among each other, the medium having a width defined as slightly less than the distance between the side walls, whereby the side walls allow vertical movement of the medium within the cavity while restricting lateral and rotational movement of the medium within the cavity, and at least one battery powered motor for providing rotational motion, the combination with the display unit with a medium displacing means

coupled to the motor for imparting at least reciprocal vertical movement to the medium, the medium displacing means comprising:

a pinion gear, a guided ring gear and a frame;

the pinion gear having external radial teeth and a concentric, cylindrical hub extending axially and concentrically on a side of the pinion gear opposite the motor; the pinion gear coupled to the motor whereby rotational motion from the motor is translated to rotational motion of the pinion gear and the cylindrical hub;

the guided ring gear having a ring gear and an appended guide portion; the ring gear being generally a ring having a hollow and internally extending radial teeth and further having an external periphery for supporting the medium; the appended guide portion having a first cylindrical pin extending concentrically into the hollow of the ring gear and a means for restricting horizontal movement;

the frame sized to receive the pinion gear and the guided ring gear and having at least two outside ends defining a vertical slot;

the guided ring gear positioned over the pinion gear so that the external teeth of the pinion gear mesh with the internal teeth of the ring gear and so that the cylindrical hub of the pinion gear contacts the first cylindrical pin of the guided ring gear, the frame positioned over the guided ring gear so that the guided ring gear is captured between the frame and the pinion gear, whereby rotation of the pinion forces the captured guided ring gear to orbit around the pinion gear.

21. The display unit of claim 17 wherein the means for restricting horizontal movement comprises:

a vertical slot disposed in an interior wall of the frame which faces the guided ring gear and sized to receive a cylindrical pin and allow vertical movement of the pin while restricting horizontal movement of the pin; and

a second cylindrical pin extending from a side of the appended guide portion opposite from the first pin and further extending into the vertical slot.

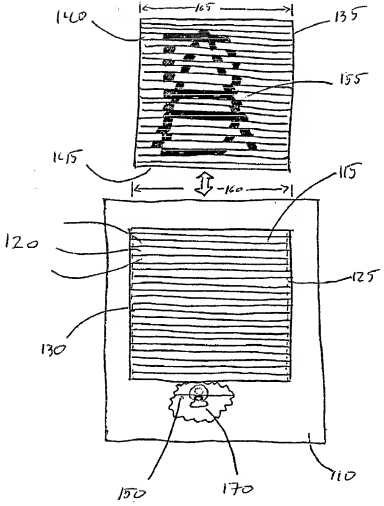
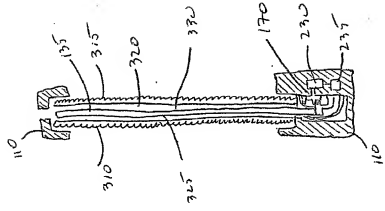


Fig. 1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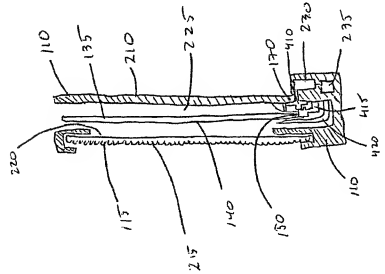
315
320
330
170
230
235
310
325
110

Fig. 3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140
150

Fig. 2

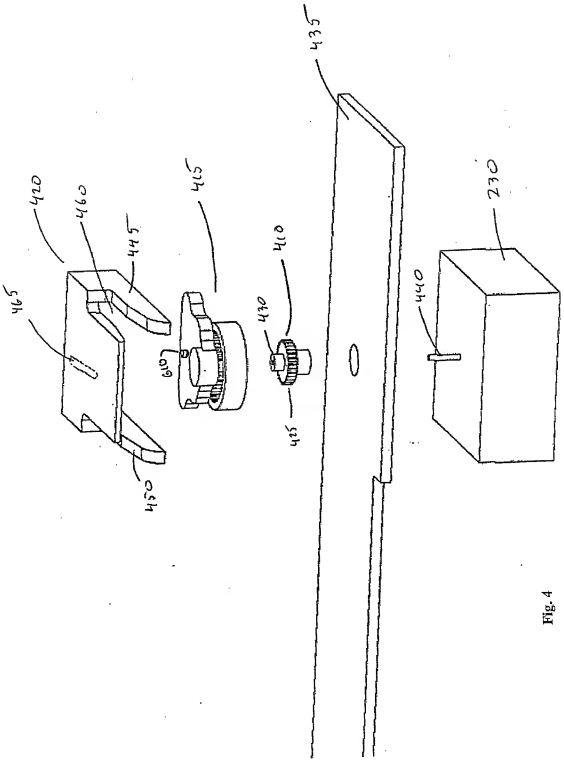

Fig. 4

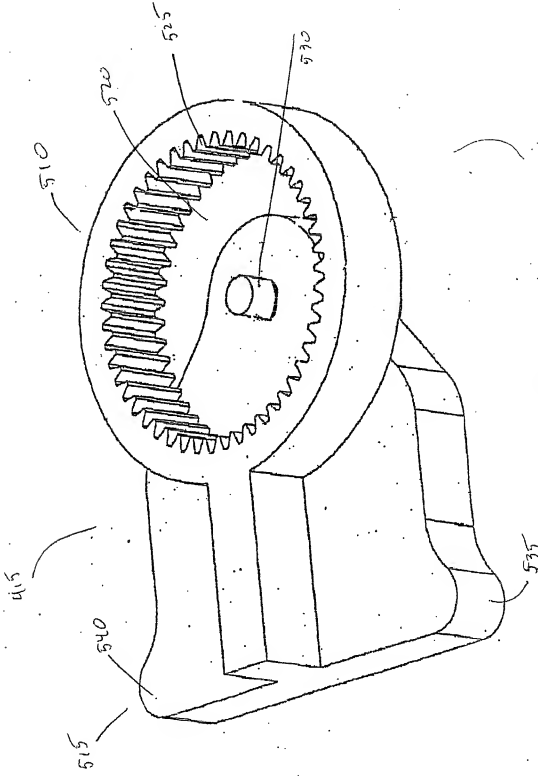

Fig. 5

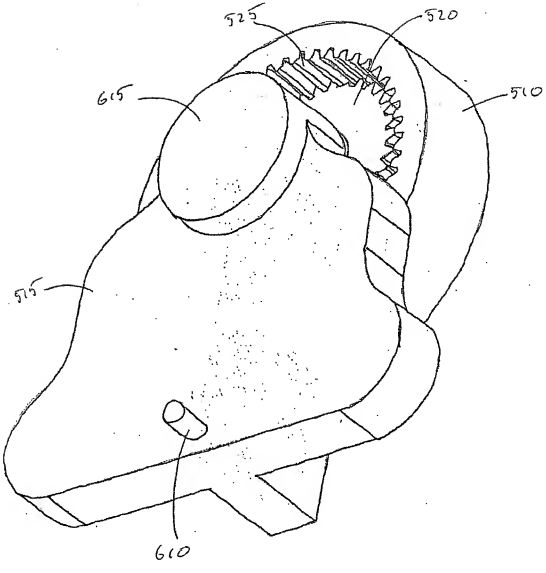

Fig. 6

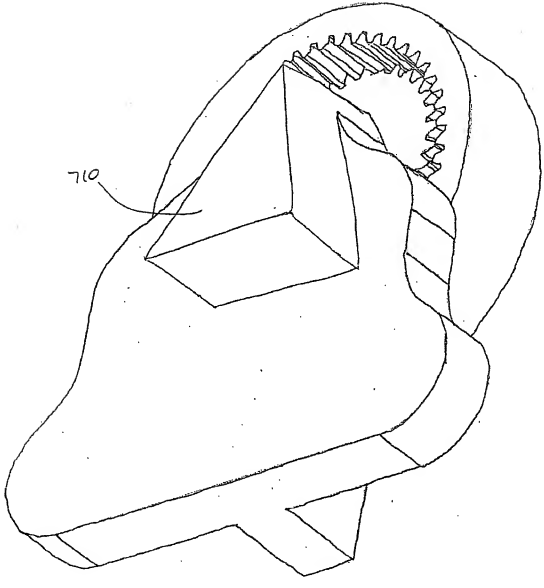

Fig. 7

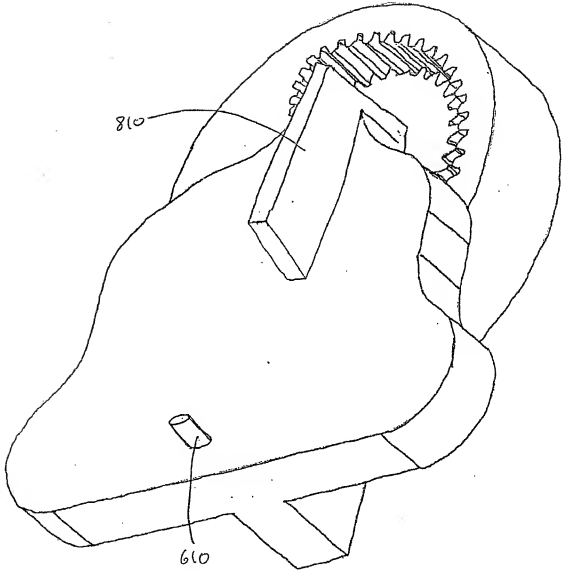

Fig. 8

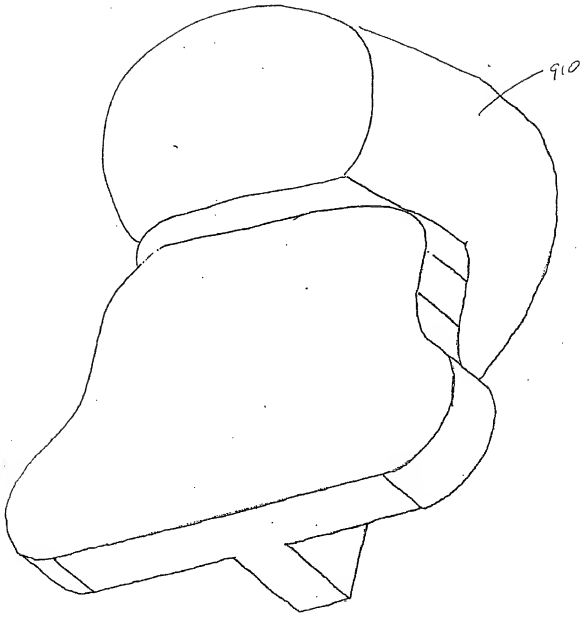

Fig. 9

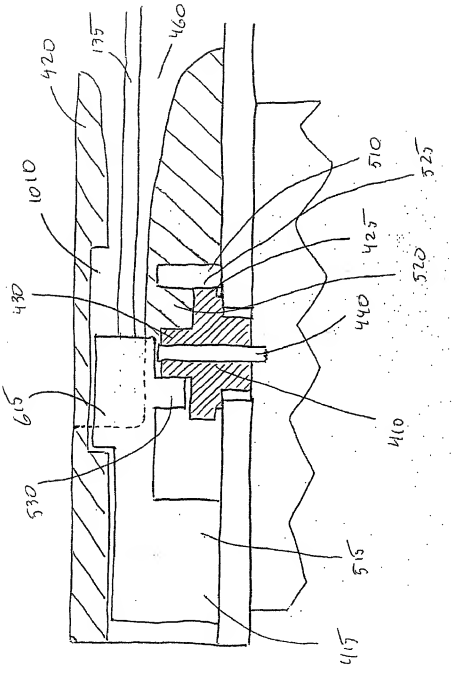

Fig. 10